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Postmortem burning of the corpses following homicide☆

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ABSTRACT

Although there have been a great number of studies focussing on antemortem burns or fire-related deaths, the present study is the first dealing exclusively with postmortem burnings aiming to cover up a homicidal action. This study aims to draw attention to postmortem burning following homicide by determining the general characteristics of a series of burned corpses.

Thirteen cases of homicide involving postmortem burning were included in the scope of the study. The cases were examined with regard to age, gender, place of death or discovery, autopsy findings, accompanying injuries and manner of death. Eleven of the cases were male and two were female. Victims' ages ranged between 24 and 62 years with a mean age of 43.5 years. All of the victims were discovered in unfamiliar places. Autopsy findings indicated postmortem burning of corpses to cover homicide.

Discovering a burned body in an unfamiliar, outdoor or abandoned place, scene or autopsy findings attributable to a violent death, presence of accelerant use and absence of vitality signs are factors indicative of postmortem burning following homicide.

1. Introduction

Throughout the history of mankind, burying, burning and throwing corpses into the water have been used to cover evidence of criminal action against individuals. Such cases, burned corpses in particular, are truly a challenge for forensic pathologists in the mean of identifying human remains and determining the cause and manner of death.[1,2] Furthermore, forensic investigation of burned corpses is expected to find out whether the victim was exposed to the fire before or after death. On the other hand, apart from burns it is crucial to examine accompanying injuries contributing to or causing death.[2,3]

Majority of (70%) fire-related deaths are determined to be accidental occurring in the home environment and 10% are reported to result from deliberately started fires.[4] However, the cause of death of some cases might be trauma or certain toxic agents and the corpses were burned after death. Medico-legal examination of burned corpses, which should clarify the identity of victim, the vitality of victim before being exposed to fire and the cause of death requires a multidisciplinary approach including crime scene investigation, autopsy and a complete toxicological analysis.[4,5] In addition, such cases should be considered suspicious, in which forensic professionals' duty is to establish whether it was an accident, a homicide or a suicide.[2]

The present study aims to draw attention to postmortem burning following homicide by determining the general characteristics of a series of burned corpses.

2. Material and methods

We retrospectively analysed records of autopsies ($n = 12{,}263$) performed in the Ankara Group Administration of Council of Forensic Medicine between 01 January 1998 and 31 December 2008. Cases ($n = 83$) involving burn injuries were examined in detail by autopsy reports, toxicological analyses, crime scene investigation and records of the public prosecutor's office. For differential diagnosis, a careful examination of vitality signs, soot deposition in lower respiratory tract and measurement of carbon

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monoxide–haemoglobin (CO–Hb) levels were performed for each case. Those cases ($n = 70$) which were exposed to the fire before death were excluded.

Thirteen cases of homicide involving postmortem burning were included in the scope of the study. The inclusion criteria were (a) the scene of discovery of the body and what is known about the background of the deceased; (b) the traumatic cause of death; (c) the absence of any vital response to the thermal changes which has to be defined; and (d) the presence of an accelerant. The cases were examined with regard to gender, age, place of death or discovery, autopsy findings, accompanying injuries and manner of death. X-ray was performed prior to autopsy in all cases. Samples of long bones and teeth were collected for DNA profiling from each case. Samples of charred fire residues from the scene and burned garments, and charred skin were obtained at the autopsy. These samples were used to investigate traces of fire accelerant by GC–MS (Gas Chromotography–Mass spectrometry). Furthermore, a complete toxicological analysis, using available tissue samples, was performed for each case. Samples of skin, organs, long bone–bone marrow and teeth were obtained for stock for possible further analyses.

3. Results

Among all the autopsies performed at the Morgue Department of Ankara Group Administration of the Council of Forensic Medicine during the period of 1998–2008, in 13 cases the findings showed postmortem burning of the corpse to cover homicidal action. Eleven of the cases were male and two were female. Ages of victims ranged between 24 and 62 years with a mean age of 43.5 years. Postmortem identification was performed by DNA matching, visual, odontological methods in 10, two and one case, respectively. The manners of 11 deaths were homicide characterised with postmortem burnings involving carbonisation of a total body surface area (TBSA) over 80%. On the other hand, the causes of death of two cases were undetermined; however, both of them were discovered in the countryside and one was wrapped in a carpet. The scene investigation and postmortem examination findings, accelerant use in particular, were strongly indicative of homicide. Of all cases, two victims were found in different burned cars, of which one had many bullet holes on the hood. One victim was found in an abandoned house and one was discovered in a burned cottage while the remaining nine cases were found in the field/countryside. In addition, crime scene investigation revealed that one victim was transported and one was dragged from a close distance to the discovery area after burning. Of the victims, two were found dismembered – prior to burning – and the lower extremities of the 62-year-old female victim were missing.

The most common cause of death was firearm injuries (five cases) followed by strangulation by any means or neck pressure (three cases). Medico-legal investigation did not reveal an accurate cause of death in two cases.

Out of all, the accelerant use was revealed in 10 cases. Gasoline was the most commonly used accelerant in seven cases, while nylon was used to set and sustain fire in three cases. Involved TBSA ranged between 80% and 100% in accelerant-used cases while it was 80–85% in the nylon-used cases. There was no soot in the lower respiratory or gastrointestinal tract except in one case revealing soot in the orofarengeal region.

Toxicological analyses showed five alcohol-positive cases with blood alcohol concentrations ranging from 24 mg dl^{-1} to 220 mg dl^{-1}, while blood alcohol concentrations were lower than 5 mg dl^{-1} in the remaining cases. The carboxyhaemoglobine levels were lower than 10% in all cases. In addition, traces of chloroform were also detected in samples obtained from a female victim.

Time since death could not be estimated for any of cases. The obtained data regarding characteristics of cases and findings of medico-legal investigations are summarised in Table 1.

4. Discussion

There have been a large number of studies focussing on the clinical aspect of burns, antemortem burns or fire-related deaths. On the other hand, only one study, by Fanton et al., describing limited features of postmortem burnings was previously conducted.[2] A detailed review of the literature revealed that the present study is the first dealing exclusively with postmortem burnings aiming to cover up homicidal action.

Discovery of a burned corpse makes forensic pathologists to clarify the manner and accurate cause of death. Postmortem burning of corpses was stated to intend to cover up homicidal action. In such cases, the discovery of a burned corpse in an unfamiliar outdoor place arouses great suspicion.[2] The diagnosis of a burned corpse to cover up a homicide requires the presence of fatal injuries inflicted by another person and the absence of the classical signs of vitality.[3,6] In accordance with these, besides supporting crime scene and autopsy findings, 11 cases were discovered in the countryside away from settlements and two were in abandoned places, which were strongly indicative of homicide. Thus, one can conclude that transporting of a corpse to the countryside after or before burning is a method used to cover up homicidal evidences, in Turkey. Contrary to our series, six out of nine victims of homicide-involved postmortem burning were discovered in homes while only one was discovered in woods and two corpses were transported to another place, in Fanton et al.[2] Although there is lack of literature about the subject we can claim that the way of covering evidence of homicide changes from country to country and even from individual to individual.

The most common cause of death was firearm injuries (five cases) followed by strangulation by any means or neck pressure (three cases). Medico-legal investigation did not reveal an accurate cause of death for two cases. Although one can accept these as sudden unexpected deaths with an unorthodox disposal of the bodies and might refuse to consider these two cases as homicide, the discovery area and circumstances of corpses and detection of accelerant use were strongly indicative of homicide. Furthermore, throughout the history of Turkey, there is not a unique example of an unorthodox disposal of the body because of religious beliefs.

Forensic assessment of burned corpses inquires whether the victim was exposed to the fire before or after death.[3,4] The most important internal indicators of exposure to the fire fumes prior to death are soot deposition in lower respiratory tract and elevated blood CO–Hb at a level of >10%.[3,7] However, in rare cases, both indicators might be negative or a slight increase in CO–Hb levels can be seen, although the victim was exposed to fire before death. On the other hand, antemortem exposure to the fire cannot always be assumed from a slightly elevated CO–Hb level and soot deposition in upper airway and gastrointestinal tract.[2,3,8,9] No soot deposition in respiratory or gastrointestinal tract was reported in a great majority of postmortem burning cases, in the literature.[2,4] In accordance with this, no soot in the respiratory or gastrointestinal tract was detected in 12 cases. However, examination of only one case revealed soot in the orofarengeal region, which is not a strong indicator of exposure to the fire fumes prior to death. In addition, a blood CO–Hb level of <10% was found in all cases. The presence of a hyperemic line between the burned and intact skin was stated to be a vitality sign as a possible index of heat exposure prior to death.[4,10] There was no hyperemic line in any of the cases of the presented series.

Table 1
Characteristics of cases and findings of medico-legal investigations.

No.	Sex	Age	Circumstances and scene	Autopsy findings	Accelerant	Toxicology	Identification	Cause of death and conclusion
1	M	58	- Fire in an abandoned cottage in garden - The corpse found naked, wearing a condom on his penis with a rope tied in the middle	- TBSA: 90% completely charred - Four stab wounds -penetrating to the chest- on the back - No soot in respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	Gasoline	BAC = 31 mg/dl COHb <10%	DNA	- Stab injury of thorarcic organs - Homicide - Postmortem Burning
2	M	61	- Discovered in field (country side) - Blood and fighting findings on the scene - Severely tortured - Retired soldier from information department - Lately, receiving death threat	- TBSA: 90%, partly charred - Removed and broken teeth. Subarachnoid hemorrhage. - Ecchymotic fracture of hyoid bone. - Stab wounds on the left knee. - No soot in respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	Kerosene	BAC <5 mg/dl COHb <10%	DNA	- Strangulation by any means or neck pressure - Homicide - Postmortem burning
3	M	44	- Discovered in field (country side) - Corpse wrapped in a carpet - Transported to the scene	- TBSA: 90%, partly charred - Partly putrefied corpse. - Fracture of hyoid bone without surrounding ecchymosis. - No soot in respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	Kerosene	BAC = 50 mg/dl COHb <10%	DNA	- Undetermined - Homicide - Postmortem burning
4	M	52	- Discovered in country side in a burned car that has bullet holes - Bullets found in the car - Lid of plastic can nearby	- TBSA: 100%, completely charred - No firearm injuries revealed since skeletal tissue and organs were severely destructed - No bullet revealed in radiography - No soot in respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	Gasoline	BAC <5 mg/dl COHb <10%	DNA	- Firearm injury - Homicide - Postmortem burning
5	F	38	- Discovered in field (country side) - A bottle of chloroform found nearby	- TBSA: 95%, carbonization - No traumatic findings - No soot in respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	Kerosene	BAC <5 mg/dl COHb <10% Traces of Chloroform	Visual	- Undetermined - Homicide - Postmortem burning
6	M	45	- Discovered in a pit in country side - The corpse wrapped to nylon - Hands and feet were tied with wire	- TBSA: 80%, completely charred except thigh - Ecchymotic fracture of left horn of hyoid bone. - Ecchymosis of soft tissue on right horn hyoid bone. - Molten nylon around the corpse - No soot in respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	- No accelerant detected - Nylon used to set the fire	BAC <5 mg/dl COHb <10%	DNA	- Strangulation by any means or neck pressure - Homicide - Postmortem burning

(*continued on next page*)

Table 1 (*continued*)

No.	Sex	Age	Circumstances and scene	Autopsy findings	Accelerant	Toxicology	Identification	Cause of death and conclusion
7	M	31	- Discovered in bathtub of an abandoned house - Bloodstains on the scene - Having argument with someone while having alcohol	- TBSA: 80%, carbonization - Four ecchymotic scalp lacerations; between 1.5 cm and 2.5 cm in size. Brain contusion. Five dermal abrasions on the mandible and left side of neck. - Molten nylon around the corpse - There was soot in orofarengeal region. - No soot in lower respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	- No accelerant deteced - Nylon used to set the fire	BAC = 220 mg/dl COHb <10%	Visual	- Cranio-cerebral injuries and Multiple blunt trauma - Homicide - Postmortem burning
8	F	62	- Discovered in field (country side) - The corpse was dismembered, lover extremities were missing - There was a wire surrounding neck as ligature	- TBSA: 100%, fourth degree burns and carbonization - Ecchymotic fracture of left horn of hyoid bone. - Ecchymotic fracture of left superior horn of thyroid cartilage. - No soot in respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	Gasoline	BAC <5 mg/dl COHb <10%	Odontological	- Strangulation by ligature (wire) - Homicide - Postmortem burning
9	M	30	- Discovered in country side - The corpse was dismembered with a cut through abdominal region - Deceased was an alleged Perpetrator of Sexual Assault - Killed by sexual assult victim's family members - Burned in killer house and transported to the discovery area	- TBSA: 85%, carbonization - Blows to the head with hammer - Ecchymotic lacerations of scalp and subgaleal hematoma - Depressed circular skull fractures opening the skull. - Multiple linear skull fractures - Subdural hematoma, diffuse cerebral and cerebellar contusions - Molten nylon around the corpse - No soot in respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	- No accelerant detected - Nylon used to set the fire	BAC = 28 mg/dl COHb <10%	DNA	- Brain damage, intracranial hemorrhage due to blow trauma - Homicide - Postmortem burning
10	M	24	- Discovered in country side (village roadside) - Two empty cases and a lead found on the scene	- TBSA: 90%, fourth degree burns and carbonization - Firearm injuries to the head - No bullet revealed in radiography - Multiple skull fractures radiating to the base of cranium - Brain damage on tracks of bullets - Diffuse subdural hematoma, cerebral and cerebellar contusions - No soot in respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	Kerosene	BAC <5 mg/dl COHb < 10%	DNA	- Firearm injury to the head - Homicide - Postmortem burning

11	M	60	- Discovered in country side - Tortured - Hands and feet were tied with wire	- TBSA: 80%, fourth degree burns and carbonization - Removed and broken teeth. - Firearm injury to head - Brain damage on tracks of bullets - Subdural hematoma of left hemisphere and cerebral contusions - No soot in respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	Kerosene	BAC <5 mg/dl COHb <10%	DNA	- Firearm injury to the head - Homicide - Postmortem burning
12	M	31	- Discovered in a burned car out of village (country side) - A partly burned pistol on the back seat - An empty case found in the car.	- TBSA: 100%, totally carbonized - Fractures of skull - Cerebromeningeal hemorrhage - Skeletal tissue and organs were severely destructed - No bullet revealed in radiography - No soot in respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	Gasoline	BAC = 88 mg/dl COHb <10%	DNA	- Firearm injury to the head - Homicide - Postmortem burning
13	M	30	- Discovered in country side - The corpse was buried except the head - A barn close to the scene was still burning - The corpse was dragged to the burial area - Two empty cases and a lead found on the scene	- TBSA: 90%, carbonization - Firearm injuries to the head, face and chest - Chest was relatively unburned - Two bullet revealed in radiography and collected during autopsy - Linear skull fracture on left parietal region - Multilple lung, hearth and great vessel injuries - Brain damage on track of bullet - Subarachnoidal hemorrhage on left hemisphere - No soot in respiratory or gastrointestinal tract - No heat hematoma - No line of demarcation	Kerosene	BAC < 5 mg/dl COHb <10%	DNA	- Firearm injury to the head, face and chest - Homicide - Postmortem burning

TBSA: Involved total body surface area.

Accelerant agents, kerosene in particular, have previously reported to be used in crimes due to easy availability. Such cases are stated to be frequently seen in forensic practice as burning corpses after pouring kerosene onto victims.[11] One of the most suspicious circumstances regarding bodies recovered from fire is the presence of an accelerant agent. In accordance, use of an accelerant agent was detected in 10 cases, in the presented series. Detected accelerant agents were kerosene (six cases) and gasoline (four cases). Large amounts of molten nylon were seen around the corpses of those that were accelerant negative, which was indicative of use of nylon to set and sustain fire.

Carbonised TBSA ranged between 80% and100%. It was 90–100% in gasoline-positive cases, 80–95% in kerosene-positive victims and 80–85% in those of nylon-used victims. Besides type of used accelerant, involved TBSA might be affected by environmental factors such as position and placement of body, burning environment as open or closed area, amount of accelerant, physical characteristics of body, etc.

Identification by fingerprints or visual identification in badly burned human corpses is often impossible due to the degree of destruction of the bodies. In the last few decades, identification by dental features has been described as one of the most reliable methods for identification of victims in severely damaged corpses.[12–16] Odontological characteristics were used in seven out of nine victims' postmortem identification, in Fanton et al.[2] On the contrary, postmortem identification of victims was overwhelmingly performed by DNA matching in 10 out of 13 cases, in our series. As a possible explanation to this disparity, odontological identification is quite uncommon due to lack of dental records, in Turkey.

The socio-demographic characteristics and ratio of postmortem burning cases might vary widely in different geographic areas and in the same geographic area over time. Postmortem burning cases constituted 15.6% of all burned bodies, in our series, while this value was 22.5% in Fanton et al. and 1.4% in Hilal et al. study.[2,17] The female to male ratio, of postmortem burning cases, was 2/11 in our series while this ratio was considerably higher (a female to male ratio of 5/4) in Fanton et al.'s study. On the other hand, the age range of the victims (the present series = 24–62 years, Fanton et al. = 25–60 years) and mean age (the present series = 43.5 years, Fanton et al. = 43.44 years) were nearly the same compared to Fanton et al.'s study.[2]

When a burned corpse is discovered in a burned car in unfamiliar places, differential diagnosis of a violent death followed by setting the car on fire and traffic accidents should be made. In both type of incidents, autopsy might reveal various traumatic findings. There were two cases involving burned cars found in the countryside away from settlements, in our series. Bullets, bullet holes on a car and a partially burned pistol were found in scene investigation of these cases; in addition, skull fractures were detected in one case, which were attributable to homicide.

As a limitation of the study, lack of related studies caused a weak discussion of data from different countries. Since the authors could not obtain the records of High Criminal Courts, the conviction rates and the motive for the homicides are not known, in these cases.

5. Conclusion

A detailed review of the literature revealed that this is the first study dealing exclusively with postmortem burning of corpses to cover up homicidal action. It showed that, besides being rare, postmortem burning of a corpse is a method used to hide evidences of homicidal action. Discovering a burned body in an unfamiliar, outdoor or abandoned place, scene or autopsy findings attributable to a violent death, presence of accelerant use and negative vitality signs are factors indicative of postmortem burning following homicide. In such cases, the main task of forensic pathologists is to clarify the manner and accurate cause of death. However, findings of crime scene investigation and postmortem examination might not obviously explain the cause and manner of death. In this respect, a complete scene investigation, a careful and detailed autopsy, histopathological examination, toxicological analyses and exclusion of exposure to the fire or fire fumes before death are of high importance.

Conflict of interest

The authors state that there is no financial and personal relationships with other people or organisations that could inappropriately influence this work.

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Ethical approval

None.

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